CHAPTER 9

SHIP AVAILABILITIES, REPAIR ACTIVITIES, AND SHIP TRIALS

When you have read and understood this chapter, you should be able to answer the following learning objectives:

- Describe the kinds of ship availabilities.
- Explain the difference between alterations and repairs.
- Identify and explain the functions of intermediate maintenance activities (IMAs), shore intermediate maintenance activities (SIMAs), ship repair facilities (SRFs), naval shipyards, and private shipyards.
- Identif y and explain the purpose of the kinds of ship trials.

A ship's effectiveness depends on its ability to function well; therefore, we have to keep it in prime condition. That means that the ship's crew routinely handles normal maintenance and repairs and that we have a dependable system for those the ship's crew cannot handle.

This chapter deals mostly with those jobs the ship's crew cannot handle and which are done by the following repair activities, which we will explain in greater detail in this chapter:

- An intermediate maintenance activity (IMA) is a repair ship (AR), destroyer tender (AD), or submarine tender (AS).
- A shore intermediate maintenance activity (SIMA) is based on land and offers services similar to those of an IMA.
- A ship repair facility (SRF) is similar to a naval shipyard but on a smaller scale and is usually based outside the continental United States.
- A shipyard is any full service naval shipyard or a civilian shipyard contracted for Navy work.

The engineering department officers and enlisted supervisors have an interest in nearly all of the work a repair activity does on their ship. You should be familiar with the procedures that will ensure the best job within the funds available. This chapter will help you understand what happens when a repair activity works on your ship.

TYPES OF AVAILABILITIES

An availability is the period of time a ship is assigned to undergo maintenance or repair by a repair activity. Only the authority granting the availability can change the allotted period of time. However, a repair activity may recommend a completion date to the granting authority or request an extension of time to complete work already underway. There are several types of ship availabilities that we will define in the next paragraphs. For example, restricted and technical availabilities differ in whether the ship is or is not ready to carry out its mission.

- A restricted availability (RA) is used to complete specific items of work in a shipyard or SRF; the ship is NOT available to perform its mission during that time.
- A technical availability (TA) is used to complete specific items of work in a shipyard or SRF; the ship IS available to perform its mission during that time.

Other types of availabilities identify the type of work to be done and where it will be done.

- A regular overhaul (ROH) availability is used to complete general repairs and alterations in a naval shipyard or other shore-based repair activity. The

schedule for an ROH for a given ship varies between 2 and 5 years according to an established cycle. An overhaul can take as little as 2 months for small ships and as much as 18 months for larger ships. ROH planning begins about 18 months before the scheduled overhaul.

- A voyage repair availability is used for repairs while the ship is underway. These are emergency repairs that are necessary if the ship is to continue on its mission, and they can be done without changing the ship's operating schedule. These repairs will be done by the ship's force if possible, or if necessary, by personnel from an IMA, SIMA, or SRF.

- A regular IMA availability is used for general repairs and authorized alterations that are not emergencies. This work is usually beyond the capability of the ship's force and is normally scheduled in advance.

- An emergency IMA availability is used to repair specific casualties and generally takes first priority at a fleet IMA.

- A concurrent availability is used for ship-to-shop work by the shore IMA, tender, or repair ship. These availabilities are usually scheduled to take place just before a regular shipyard overhaul or restricted availability.

Before we get into the personnel and procedures related to repair activities, it will be helpful to define repairs and alterations.

REPAIRS AND ALTERATIONS

Corrective maintenance and repairs to ships may be divided into the general categories of repairs, alterations equivalent to repairs, and alterations.

REPAIRS

A repair is defined as the work necessary to restore a ship or an article to serviceable condition without change in design, in materials, or in the number, location, or relationship of parts. Repairs may be done by ship's force, by repair ships and tenders, by SRFs, or by naval or civilian shipyards.

ALTERATIONS EQUIVALENT TO REPAIRS

Before we discuss alterations, we need to understand that NAVSEASYSCOM may determine that some work requested as an alteration may be better defined as an alteration equivalent to repair. In that case, NAVSEASYSCOM forwards the request to the appropriate type commander (TYCOM) to be handled as a repair. An alteration is considered to be an alteration equivalent to a repair if it meets one or more of the following conditions:

- Materials that have previously been approved for similar use and that are available from standard stock are substituted without other change in design.

- Worn out or damaged parts, assemblies, or equipment requiring renewal will be replaced by those of a later and more efficient design that has been previously approved.

- Parts that require repair or replacement to improve reliability of the parts and of the unit will be strengthened, provided no other change in design is involved.

- Equipment that requires no significant changes in design or functioning but is considered essential to prevent recurrence of unsatisfactory conditions will be given minor modifications.

ALTERATIONS

This chapter deals only with ship alterations (SHIPALTs) as opposed to ordnance alterations (ORDALTs). These are alterations to the hull, machinery, equipment, or fittings that includes a change in design, materials, number, location, or relationship of the component parts. This is true regardless of whether the SHIPALT is undertaken separately from, incidental to, or in conjunction with repairs. NAVSEASYSCOM, the forces afloat, or CNO may originate requests for SHIPALTs.

One of NAVSEASYSCOM's prime responsibilities for ship maintenance is to administer SHIPALTs under its technical control. NAVSEASYSCOM keeps informed of technical developments in its day-to-day relations with the forces afloat, the naval shipyards, private industry, and research centers. NAVSEASYSCOM may determine that a particular ship or class of ships should be altered to bring them to a more efficient and modern state of readiness. These alterations may include changes such as those in the following examples: Changes to the hull may strengthen bulkheads or change deck arrangements to provide space for machinery. New machinery may be added or old machinery made more efficient. Equipment may be replaced with more efficient types or new designs.

When the commanding officer of a ship believes a SHIPALT is necessary, he sends a request to NAVSEASYSCOM via the administrative chain of command. Copies of the request are sent to all ships of the type within the fleet with requests to comment on the value of the SHIPALT for other ships of the type.

The reports of the Board of Inspection and Survey (INSURV) are another source of recommended SHIPALTs. When the board completes each material inspection of a ship, it's report includes a list of recommended repairs, alterations, and design changes. NAVSEASYSCOM normally will not act on those recommendations until the commanding officer of the inspected ship requests the changes, and the TYCOM approves.

TYCOMs (or other administrative commanders) must endorse all requests for SHIPALTs addressed to NAVSEASYSCOM. Their endorsements must include recommendations for or against approval, classification, and applicability to other ships of the type. Copies of the basic request and endorsements are forwarded to other concerned TYCOMs with requests to comment on them for the information of NAVSEASYSCOM.

SHIPALTs fall into two broad categories: military SHIPALTS and technical SHIPALTs. A military alteration is one that changes the ship's operational and military characteristics and improves the ship's operational capabilities. Only CNO can approve a military SHIPALT. A technical SHIPALT is one that improves the safety of personnel and equipment and/or improves reliability, ease of maintenance, and efficiency of equipment. Technical SHIPALTs are approved at the NAVSEA level. If there is a question as to whether a proposed SHIPALT is military or technical, NAVSEA will forward the proposal to CNO for determination. Approved military and technical SHIPALTs are ranked in order of priority on an annual basis in the Amalgamated Military and Technical Improvement Plan. The decision to install a SHIPALT is based on the priority of the alteration in the Amalgamated Military and Technical Improvement Plan, funding, ship availability, and whether material is available to complete the SHIPALT. When a decision is reached to install a SHIPALT during a given fiscal year, the alteration is entered into the Fleet Modernization Program (FMP). Approved SHIPALTs are authorized by letters issued not less than 180 days before the ship is scheduled to begin overhaul.

REPAIR ACTIVITIES

Repair activities are set up to do work the ship's forces cannot handle. Repair activities are IMAs, SIMAs, SRFs, and shipyards, and they were defined at the beginning of this chapter. The type of work and available funds govern the assignment of repair work to repair activities. The office of the Supervisor of Shipbuilding (SUPSHIP) places and administers contracts for the repair or overhaul of naval ships at private shipyards, and contracts for civilian work to be done in IMAs, SIMAs, and SRFs. We will explain SUPSHIP in more detail later in the chapter.

Fleet and type commanders usually may call on IMAs or SIMAs to handle repairs and alterations under regular, emergency, and concurrent availabilities. If work is beyond an IMA's or SIMA's capability, other activities ashore, such as an SRF or a shipyard, will do it. We will discuss work done by the ship's forces, IMAs, SRFs, and shipyards in the following pages. In addition, we will examine the organization, duties of personnel, and procedures used in an IMA and a naval shipyard.

SHIP'S FORCE MAINTENANCE AND REPAIRS

Each ship's force should be able to make its own normal repairs. To do that, each ship should have the necessary materials, repair parts, tools, and equipment. The most competent and experienced personnel should supervise these repairs. If ship's personnel are not familiar with the needed repairs and tests, or cannot handle a problem for any reason, the CO should request an IMA or shipyard availability. Supervisory personnel who are not familiar with these repairs and tests should learn from personnel who are familiar with them while the ship is in an IMA or SIMA availability. If the ship's force needs technical assistance, they should request it from the local TYCOM's maintenance representatives.

The ship's force should follow a regular schedule of preventive maintenance to be sure that equipment and machinery are always ready for service. This includes cleaning, inspections, operations, and tests to ensure trouble-free operation and to detect faults before they become major problems. Some inspections and tests are quite simple; others require planning so they can be done during upkeep or overhaul periods.

INTERMEDIATE MAINTENANCE ACTIVITIES

You learned earlier in the chapter that IMAs are repair ships (AR), destroyer tenders (AD), and

submarine tenders (AS), and SIMAs are shore IMAs. SIMAs are an outgrowth of the Atlantic Fleet's Fleet Maintenance Assistance Group (FMAG) and the Pacific Fleet's Development and Training Center (DATC). For convenience, we will refer mostly to IMAs in this section, but the information will normally refer to both IMAs and SIMAs.

While each type of IMA has its special purpose, all of them have many characteristics and facilities in common that make them suitable for general repair work on most ships. Repair ships and tenders perform battle and operational damage repairs on ships in the forward areas, and they provide logistic support to ships of the fleet. They also can provide other services, including medical and dental treatment, for the ships they tend. Their shops can handle hull, machinery, electrical, and ordnance work and they stock parts to help them deal with most of the repairs they perform. Ships are assigned to IMAs with a flexible approach that considers unusual repair requirements and operational commitments, particularly for ships outside the continental United States.

Ships are scheduled for regular IMA availabilities or upkeep periods at certain intervals of time that vary with different types of ships. The availability periods are usually planned in advance and they depend upon the quarterly employment schedule of each ship.

A ship's commanding officer sends a request for an IMA availability with a forwarding letter to the TYCOM or his representative. The request must include job sequence numbers (JSNs) for work requests in the Current Ship's Maintenance Project (CSMP) and a listing of TYCOM master job catalogue work items.

A reviewing officer with TYCOM will review the request and make any necessary corrections to conform to established policies and procedures. Most of the ship's work list items will be approved, but the ship may have to furnish more detailed information on certain work requests. The reviewing officer will forward the approved ship's work requests to the appropriate IMA. He does this well in advance of the period of availability so the IMA repair department personnel can prepare for the work. You should know something about these personnel before you learn about the arrival conference, the shops, and the ship maintenance procedures, so we will discuss them in the following pages.

REPAIR PERSONNEL

Standard Organization and Regulations of the U.S. Navy, OPNAVINST 3120.32, contains general information about the relative positions and responsibilities of IMA departments. Also, TYCOMs issue standard ship organizations for their type that describe the organization for every routine function and most emergency conditions that can exist aboard ship.

The IMA's commanding officer is assisted by the executive officer who also acts as the CO's direct representative. The XO is responsible for the daily functions that affect the IMA as a whole and he coordinates the activities of the IMA's departments and divisions. The following pages explain the roles of the repair officer, the assistant repair officer, the repair division officers, the diving and salvage officer, the gas free engineer, and enlisted personnel.

Repair Officer

The repair officer is head of the repair department on an IMA. He oversees the upkeep, operation, and maintenance of the equipment assigned to the repair department, and the training, direction and coordination of its personnel. He keeps up with production and ensures efficient and economical operation of the production process.

Assistant Repair Officer

The assistant repair officer assumes the repair officer's responsibilities in his absence and carries out responsibilities the repair officer delegates. This officer usually handles the internal administration of the department and specifically keeps progress records on all work.

Division Officers

The division officers have both administrative and production responsibilities for the actual work that is done in shops under their supervision. Their administrative responsibility is in the administration of personnel in their respective divisions, including the assignment of berths and watches, and all training and training records. Their production responsibilities include oversight of all work requests and review of progress, requisitions for material, proper operation of division shops for which they are responsible, safety, and progress reports to the repair officer.

Diving and Salvage Officer

The position of diving and salvage officer may be a separate assignment or a collateral duty for an officer in

the repair department. In either case, the diving and salvage officer is responsible for the supervision of all diving operations, the maintenance of diving and salvage equipment, and compliance with diving instructions and precautions.

Gas Free Engineer

The hull repair officer is generally assigned additional duty as the gas free engineer. His primary responsibility is to ensure compliance with all precautions set forth by NAVSEA; *U.S. Safety Precautions For Shore Acclivities,* NAVMAT P-5100; ship's regulations; and other regulations issued by higher authority. He determines whether there is danger to personnel or equipment from noxious or explosive gases during any operation aboard ship or during work on ships alongside, and stops such work when necessary.

Enlisted Personnel

Navy enlisted personnel provide the technical skills required aboard IMAs. The *Occupational Standards,* NAVPERS 18068, contain detailed information on the enlisted rating structure.

ARRIVAL CONFERENCE

An arrival conference is usually held immediately when a ship begins an IMA availability or an upkeep period. Representatives of the ship, of the repair department, and usually of the TYCOM attend the conference. They discuss the relative needs of the ship and the urgency of each job and approve/disapprove work requests, clarify uncertainties, and arrange for temporary services such as electricity and steam.

SHIP/IMA WORK COORDINATION

Ship's engineering personnel must know the status of work underway during an IMA availability whether that work is being done by the ship's force or the IMA. You need this information to coordinate your own work with that being done by the IMA. There are three basic kinds of work that require coordination: (1) Equipment removed by the ship's force to be delivered to the IMA for repair, (2) equipment dismantled by the ship's crew so they can send parts to the IMA for repair (also known as ship-to-shop jobs), and (3) repairs the IMA force is making on the ship.

The IMA usually appoints a ship superintendent, a chief petty officer who should always know the status of all jobs on the ship and on the IMA. If the IMA does not appoint a ship superintendent, then the ship should appoint a petty officer for that purpose. The person in this position is liaison between the ship and the IMA for all work in progress and completed, and all tests required and completed. He keeps a daily running progress report of each job and reports that information daily to the ship's representative.

REPAIR DEPARTMENT

You need a general idea of the shops composing the repair department and their functions. In this section, we will describe the shops as they are organized in the divisions on a destroyer tender (AD), which is representative of all IMAs.

Hull Repair Division

The hull repair division consists of the shipfitter shop, the sheet metal shop, the pipe and copper shop, the weld shop, the carpenter shop, the diving locker, and the canvas shop. We will explain each of them in the following sections.

SHIPFITTER SHOP.— These personnel make repairs on the hull, test pad eyes and structures with a dynamometer, and handle alterations designated for forces afloat.

SHEET METAL SHOP.— These personnel make all types of repairs and fabrications on light gauge sheet metal and handle alterations designated for forces afloat.

PIPE AND COPPER SHOP.— These personnel fabricate and repair most pipe and tubing, test completed work hydrostatically, and handle alterations designated for forces afloat.

WELD SHOP.— These personnel weld most metals including high-pressure welding on boilers. They repair castings, stress relieve castings and forgings, forge special tools and hull fittings, and case harden low-carbon steel. **(NOTE:** The nondestructive testing laboratory performs all nondestructive testing used to test the quality of the welds.)

CARPENTER SHOP.— These personnel repair and fabricate most items made of wood; test damage control air test equipment, flame safety lamps, and explosion meters; lay linoleum tile, magnetite, and terrazzo covers on decks; and fill CO_2, bottles. The pattern shop functions under the carpenter shop and fabricates patterns of wood, metal, and plastic for templates and foundry castings.

CANVAS SHOP.— These personnel fabricate miscellaneous canvas covers, awnings, and boat cloths, and they repair furniture using leather and cloth fabrics.

DIVING LOCKER.— These personnel inspect the underwater portion of the hull and prepare the underwater hull reports for the repair officer. They also replace propellers on destroyers and small ships and repair or replace other items underwater as needed. They clean propellers, sonar domes, sea chests, and large injection valves; clear fouled propellers and sea chests; and maintain the diving boat and diving equipment in repair and operational readiness.

Machinery Repair Division

The machinery repair division consists of the inside machine shop, the outside machine shop, the boiler shop, and the foundry shop. We will explain each of them in the following paragraphs.

INSIDE MACHINE SHOP.— These personnel repair or fabricate mechanical parts that require work done on machine shop tools and equipment. They do metal plating and engraving, and they test metals to determine their characteristics. They also handle alterations designated for forces afloat.

OUTSIDE MACHINE SHOP.— These personnel shop test and repair all types of machinery used in naval ships. They also handle alterations designated for forces afloat.

BOILER SHOP.— These personnel shop test, inspect, and repair boilers of naval ships.

FOUNDRY SHOP.— These personnel pour castings of various metals to produce repair parts and whole items used on the ship.

Electrical Repair Division

The electrical repair division consists of the electric shop, the gyro shop, the printing shop, and the photo shop.

ELECTRIC SHOP.— These personnel inspect, test, repair, and make adjustments to nearly all electrical equipment, and they also handle electrical alterations designated for forces afloat.

Electronics Repair Division

The electronics repair division consists of the electronics shop and the calibration shop.

ELECTRONICS SHOP.— These personnel align and repair all types of electronic equipment, make field changes, and maintain an electronics publications library.

CALIBRATION SHOP.— These personnel repair and calibrate most test equipment used on naval ships.

SHIP REPAIR FACILITIES

Most SRFs are located outside the continental United States. They are supervised by naval officers who are assisted by enlisted and U.S. civilian personnel. Other personnel are citizens of the country where the SRF is located. An SRF has drydocks and shops that can handle nearly all ship repair work. They normally handle voyage repairs and overhauls of ships that are based in the area. They do not do new construction.

SRF organization is based on standard naval shipyard organization modified for local conditions. Figure 9-1 shows a typical SRF organization.

ADMINISTRATION AND CONTROL

An SRF is under the control of a commanding officer, usually a captain. It is part of a fleet or shore-based activity that exercises military command. The SRF staff includes a planning officer, an administrative officer, a management engineering officer, and sometimes a general manager for civilian personnel who acts only as an advisor. An SRF provides logistic support including drydock overhaul, repair, alteration, and conversion of naval ships and service craft, and ships and craft of other U.S. government departments as assigned. They also perform voyage repairs and related work and they install and maintain shore-based electronic equipment and provide technical assistance to assigned naval activities.

PLANNING AND ESTIMATING (P&E)

The planning department is under the direction of the planning officer who is a senior engineering duty (ED) officer. It does all planning, estimating, designing, scheduling, and reporting. It is patterned after those in naval shipyards but on a smaller scale.

The P&E superintendents' billets are tilled by ED officers. They include a senior P&E superintendent, assistant superintendents for material and finance, and other related military and civilian positions depending on the amount of work done at the SRF. The planning department is the first point of contact for a customer ship.

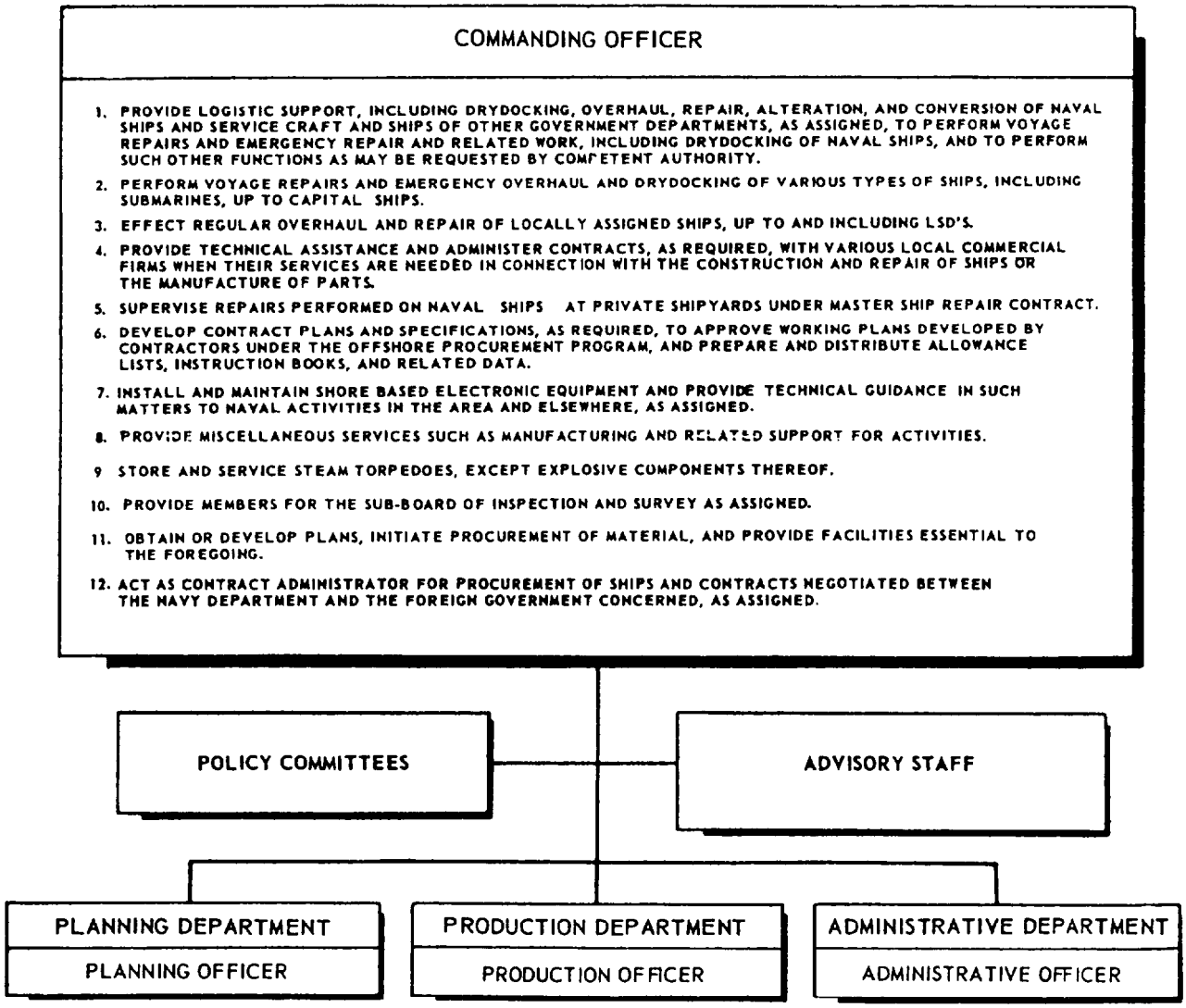

Figure 9-1.-Typical ship repair facility organizational chart.

The service squadron or local mobile support group assigns the work to be done on the ship. The assignment is based on funds allotted by the TYCOM, and the SRF may not do work that exceeds that limit. The planning department estimates the work that can and cannot be done within the set funding limit. This estimate serves two purposes: It helps the ship and the SRF planners decide on priorities, and it helps the planners assign a list of work requests that the shops will not exceed.

PRODUCTION DEPARTMENT

The production department is under a senior ED officer called the production officer. It is generally patterned after a naval shipyard except that it does not do new construction. Personnel include superintendents and assistant superintendents, who are mostly ED officers, civil service personnel, and local personnel. We will explain the duties of key personnel in the following pages.

Repair Division

This division is headed by the repair superintendent, who is usually an ED officer. He is responsible for the completion of all work requests. He supervises a staff of military and civilian specialists who in turn supervise the various shop masters. The military staff of the repair division may have a parallel civilian staff made up of civilians. These civilians provide liaison with local shop personnel, furnish continuity to bridge rotation of officers, and provide direct technical assistance.

There is a shop for each of the following specialties: hull, machinery, ordnance, electrical, and electronics. Each shop is supervised by a shop master who is either

a U.S. civil service employee or a local employee, as are their lower-level supervisors. These shop masters are assistant repair superintendents who supervise all work done in their specialties whether in their shops or on the ships. **(NOTE:** Some fleet activities have a ship repair department, or SRD, rather than a repair division.)

The assistant superintendent who is responsible for hull work is also responsible for drydocking. The actual drydocking is supervised by a docking officer who is usually an ED officer with special docking qualifications. *Navy Regulations and the Naval Ships' Technical Manual* require that the docking officer take responsibility for the ship when it starts to cross the sill of the drydock, and give responsibility back to the ship's CO when the ship clears the sill on the drydock on its way out. We will discuss docking in more detail later in the chapter.

Shop Division

This division maintains and supports the equipment and structures in the shops. It is headed by a shop superintendent, usually a LCDR, who may be an ED officer or line officer. The division also handles production methods, safety, stores, and housekeeping. In a naval shipyard, this division would also be responsible for industrial supervision, but the repair division handles it in an SRF. The shop superintendent usually has a junior officer as assistant shop superintendent and safety officer.

Ship Superintendent

The repair superintendent also supervises a group of officers called ship superintendents. They are junior ED officers or line officers whose duties parallel those of the ship superintendents in IMAs, SIMAs, and naval shipyards. When a ship is assigned an availability, the repair superintendent assigns a ship superintendent for that ship. The ship superintendent gets copies of all work requests that are sent to the ship and the shops to help them keep track of all work in progress on the assigned ship. The ship superintendent is liaison between the ship and the repair superintendent. He directs all work on the ship and coordinates all work done in the shops. He coordinates all tests, changes in work requests, ordering of material, and sign-offs of work orders for his assigned ship.

NAVAL SHIPYARDS

Naval shipyards are under the control of the Naval Sea Systems Command (NAVSEASYSCOM). Each ship in the active fleet is assigned a home yard and a planning yard. The home yard is the naval shipyard at which a ship usually gets its regular overhaul. CNO assigns the home yard based upon the geographic assignment of the ship and NAVSEASYSCOM recommendations.

NAVSEASYSCOM assigns the planning yard One naval shipyard or other activity is assigned as a planning yard for each ship type. The planning yard provides design services and keeps up-to-date tiles of working drawings and selected records and data. The planning yard usually does the design work for the class of ship assigned and provides the required drawings to each of the other shipyards working on ships of the class. The planning yard also may handle central procurement of material.

Shipyard management is responsible for all phases of naval shipyard activity. The line of authority and control passes from the shipyard commander through the heads of departments, divisions, and offices to the administrative units. See the *U.S. Navy Regulations* and Navy Department directives for additional information on naval shipyard management and organization. Figure 9-2 shows the organization of a typical U.S. naval shipyard.

A ship's engineer officer will be most concerned with the planning and production departments. The planning department prepares plans and orders material, and the production department is made up of the shops that do the actual repair work on the ship. We'll discuss both in the next paragraphs.

PLANNING DEPARTMENT

Before a ship begins an overhaul, the shipyard's planning department usually receives a copy of the ship's worklist and the amount of funding, both approved by the TYCOM. The planning department uses that information to develop preliminary estimates of the work that can be done with the available funds. It sends them to the production department where the production control branch of the repair division uses the estimates to schedule the workload. Next, the planning department prepares requisitions for material requiring long lead time, and issues a preliminary work booklet for repairs. Figure 9-3 shows the organization of a typical planning department.

When a ship is to be overhauled, the shipyard tries to send representatives to inspect the ship before it reaches the shipyard. They check plans against actual conditions and make any adjustments before the ship

reaches the shipyard, and they hold a pre-arrival conference with the ship's officers and the TYCOM's representative.

When the results of a pre-arrival inspection, or other firm information, are available, the planning department prepares job orders based on ship work requests. It also prepares a list of the materials needed to do the job or a budget figure if no list is available. Then they send the job order and material list to the production department where the repair division adds key operation dates and material required dates (MRD).

Sometimes there is a need for work that could not be foreseen and the planning department issues work request supplements to cover those situations. These supplements are restricted and should be used only when necessary.

The planning department prepares allowance lists, such as the COSAL, for newly constructed ships, and corrects existing allowance lists for ships for which the shipyard is the home yard. These are lists of equipment components, repair parts, or material needed to operate, maintain, and repair the ship for specified periods of time. They are based on plans, material requisitions, or individual job orders related to the ship's equipment.

The planning department's design division issues procedures to carry out tests of equipment and work. (The combat systems office and nuclear engineering department conduct their own tests.) The procedures include any special measures and safety precautions and an outline of the reports to be made on the test results. Each ship undergoing overhaul assigns inspectors and representatives from each department to inspect work and witness tests, since these are a responsibility of the commanding officer as outlined in *U. S. Navy Regulations.*

PRODUCTION DEPARTMENT (SHOPS)

The production department is made up of all of the shops in a naval shipyard and is supervised by the production officer. Each shop is a unit that is assigned specific work, usually by trade. Most shops are assigned to the production department, but they usually do work for the entire yard. (The transportation, power plant, and maintenance shops are assigned to the public works department.) Figure 9-4 shows the organization of a typical production department.

Each shop in the production department is assigned to a shop group consisting of one or more shops. Each shop group has a civilian superintendent who is responsible for the organization, administration, personnel training, and general supervision of his shop group. A civilian superintendent is in charge of each

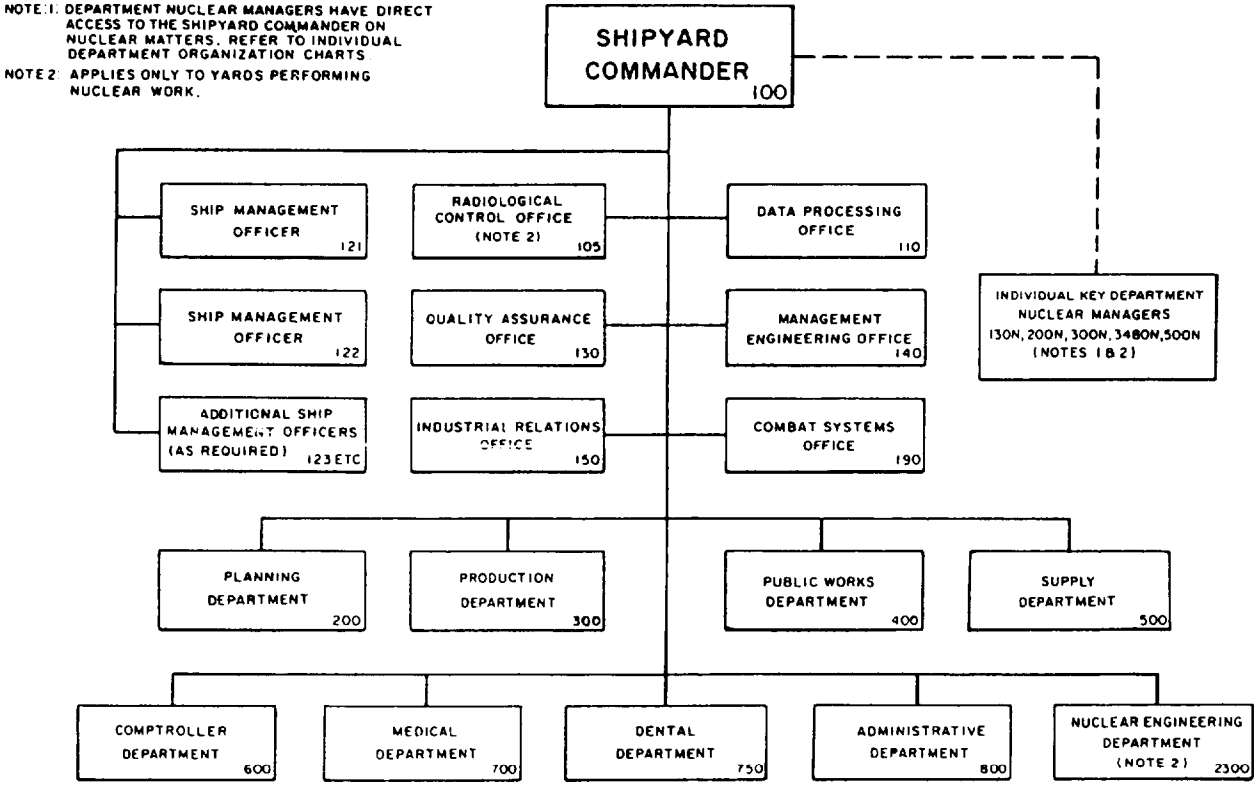

Figure 9-2.-Organization of a typical naval shipyard.

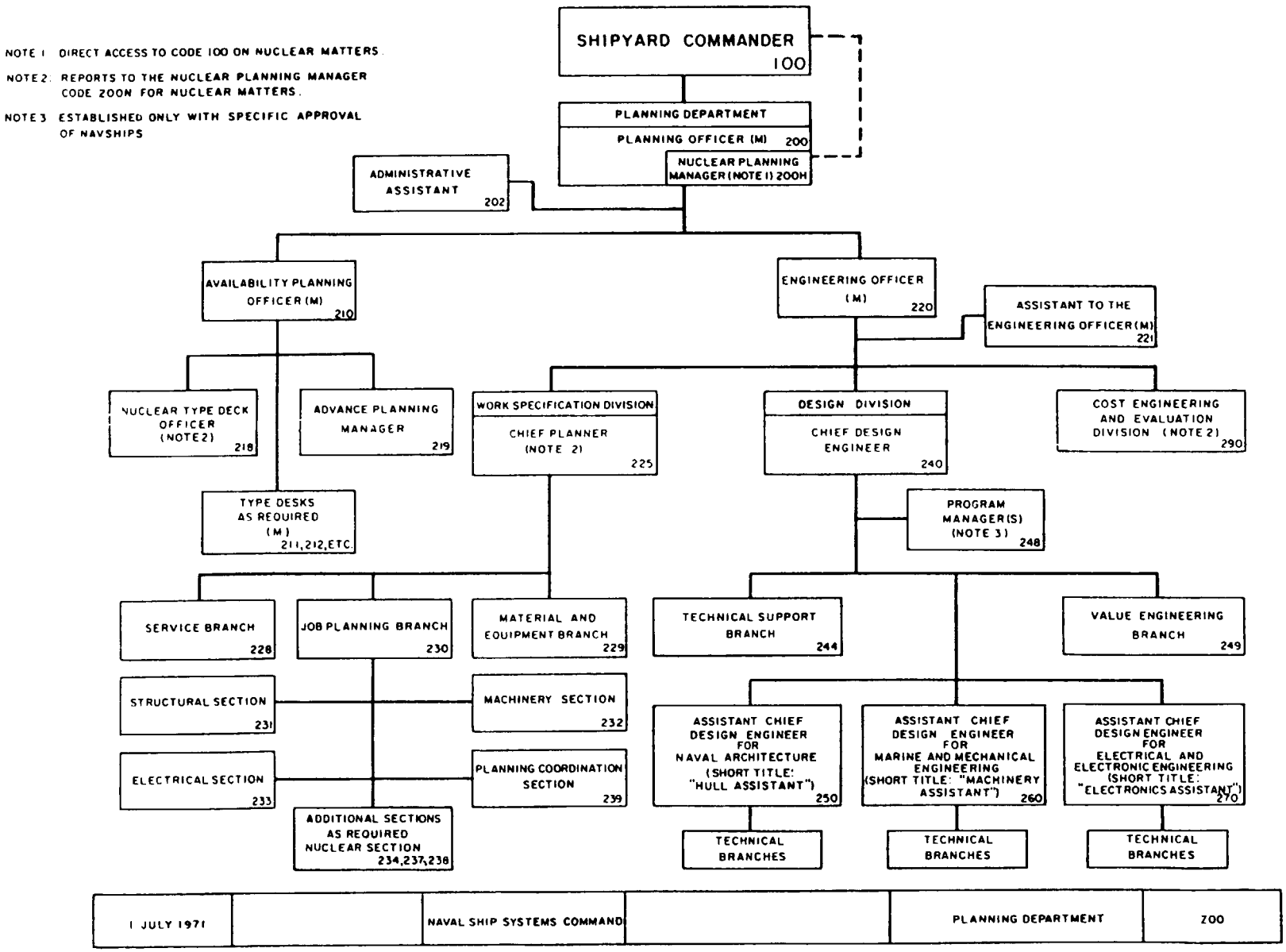

Figure 9-3.–Organization of a typical naval shipyard planning department.

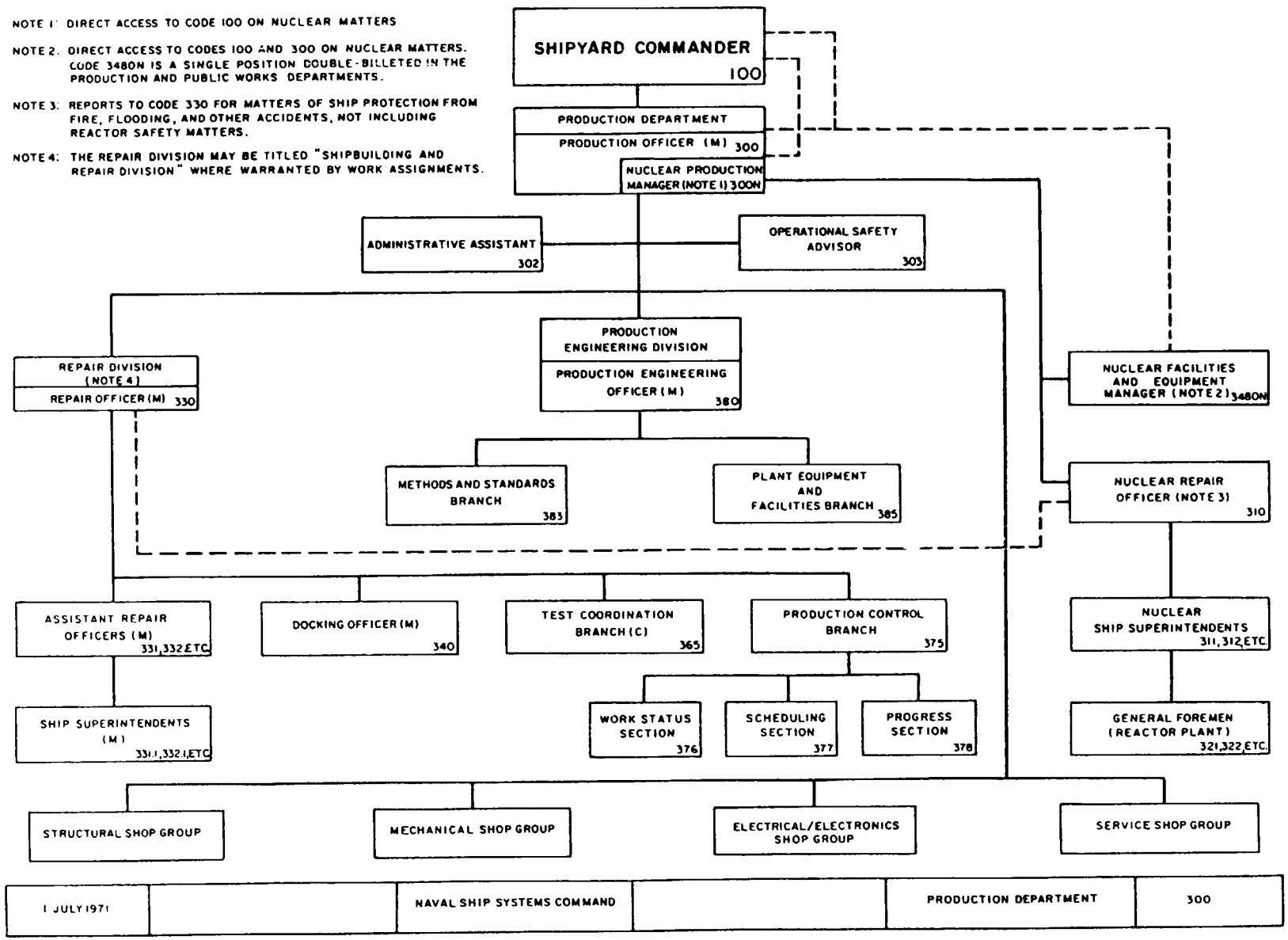

Figure 9-4.–Organization of a typical naval shipyard production department.

shop and is responsible to the shop group superintendent. Figure 9-5 shows the organization of a typical shop group.

Figure 9-6 shows a typical shop organization. Each shop is assigned a number and a name. Some shipyards do not have all shops, but all shipyards have some shops in common, and some shops may have combined trades. The following list shows the numbers and names of the shops that are common to all shipyards. Many of these shops were described in a little more detail under the section on Intermediate Maintenance Activities earlier in this chapter.

06 Central tool

11 Shipfitters' shop

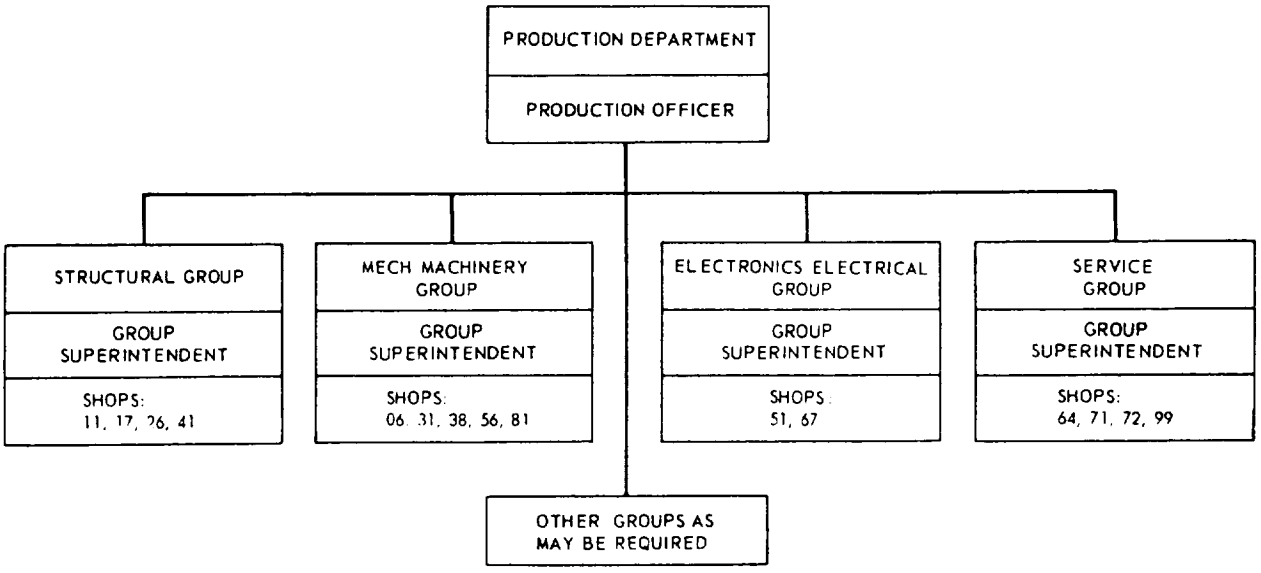

Figure 9-5.-Shop group organization of the production department.

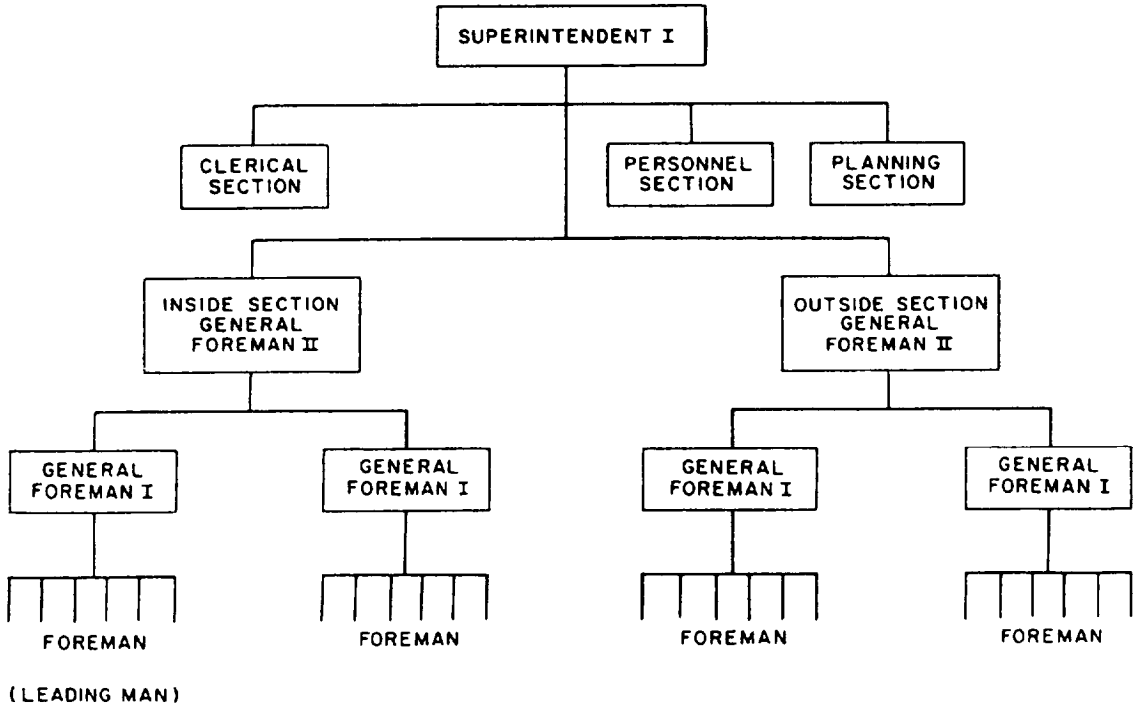

Figure 9-6.-Organization of a typical production department shop.

17 Sheet metal shop

26 Welding shop

31 Inside machine shop

38 Outside machine shop

51 Electric shop

56 Pipe and copper shop

64 Woodworking shop (may include 94 pattern shop)

67 Electronics shop

71 Paint shop

72 Riggers and laborers shop (may include 74 sail loft)

74 Sail loft

99 Temporary service shop

The following list shows the numbers and names of production department shops located only in certain shipyards:

23 Forge shop

25 Gas manufacturing shop

27 Galvanizing shop

35 Optical shop

36 Weapons shop

37 Electrical manufacturing shop

41 Boiler shop

68 Boat shop

81 Foundry

94 Pattern shop

The Ship Superintendent

The ship superintendent is a position common to most repair facilities; his major role is as liaison between the ship and the repair facility. In this case, he represents the shipyard repair superintendent who, in turn, represents the production officer. The ship superintendent is responsible for completion of all authorized work on a given ship while it is in the shipyard. He keeps an office on board the ship and acts as liaison between the ship and the shipyard.

It is customary to assign a ship superintendent well before the ship enters the yard to give him time to prepare. Between the time he is assigned and the time the ship arrives, the ship superintendent reviews all available information on the condition of the ship and the plans for work in the shipyard. He learns who will prepare the plans and coordinates progress on any work that must be done before the ship arrives. The ship superintendent meets the ship when it arrives and makes sure the required services are furnished promptly. He delivers to the commanding officer (or executive officer) copies of orders and regulations that cover points that affect the ship and the shipyard. He also tries to hold a meeting with the ship's department heads to review plans for the overhaul and begin coordination.

The ship superintendent attends the frequent progress review conferences the shipyard commander holds with the commanding officer of each ship in the shipyard. He also holds frequent conferences with shop personnel, ship personnel, the cognizant type desk officer, and other yard personnel to ensure the timely completion of all authorized work.

At least one day before the end of the overhaul, the ship superintendent holds a departure conference with the ship's representatives. They agree on last-minute adjustments or corrections, sign work requests that were not previously signed by the ship's representatives as "completed," or "completed, subject to final test." If any work is found to be unsatisfactory, the responsible officer records the reasons. This conference determines status of all authorized work including uncompleted work that should be done during the ship's next availability. The ship superintendent reports the status of all job orders to the planning department, which then prepares the departure report.

Work Requests

In nearly all cases, any work done in a shipyard must have a work request, OPNAV 4790-2K, whether the job is the overhaul of a single piece of equipment that requires one work request or a major SHIPALT that requires any number. You will find the procedures used to submit work requests in OPNAV instructions. Submit the work requests to the TYCOM with enough advance time to allow his review and approval and to reach the shipyard at least 60 days before the work will be done. While most work requests originate on the ship, others may come from other sources, such as an INSURV inspection that recommends an alteration.

When work requests originate on the ship, the CO, XO, and department heads hold a conference to set priorities. They will use those priorities to prepare a work list that includes brief statements of the work to be

done and submit it to the TYCOM for review. The TYCOM forwards the approved requests either to the naval shipyard or SUPSHIP.

Ship Alterations

Each year the TYCOMs send NAVSEA a list of the SHIPALTs recommended for completion during the next fiscal year overhaul. NAVSEA reviews the lists and uses them as the basis for its own list of authorized SHIPALT that it publishes in the Fleet Modernization Program (FMP).

Some SHIPALTs are planned by a Planning and Engineering for Repairs and Alterations (PERA), and those plans reach the shipyard by other routes that we will not discuss here. For our purposes, NAVSEA sends a 180-day letter to the TYCOM and to the shipyard's planning department. The letter contains a priority list of SHIPALTs to be completed during the scheduled overhaul and a funds grant to cover the cost of the work.

About 90 days before the ship arrives at the shipyard, NAVSEA sends the shipyard, the TYCOM, and the ship a 90-day material status letter. This letter contains a list of approved alterations in priority order for each ship and any changes in the work that was authorized in the 180-day letter.

SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR

Each naval district has a Supervisor of Shipbuilding, Conversion and Repair, USN (SUPSHIP) under the NAVSEASYSCOM. SUPSHIP might be called the commercial arm of naval ship construction, conversion, alteration, overhaul, and repair. It alone can contract with private repair organizations for work on Navy ships in private shipyards, naval shipyards, IMAs, SIMAs, or SRFs. Its major role is to procure private contracting repair services where Navy repair services are not equipped to handle the job. Civilian contractors may provide these services entirely, as in new ship construction or overhauls in a civilian shipyard. They also may work in conjunction with naval personnel in naval shipyards, IMAs, SIMAs, and SRFs. An officer in charge heads the Office of the Supervisor of Shipbuilding. This officer has many of the same oversight responsibilities as a shipyard commander in a naval shipyard. SUPSHIP is responsible for the following tasks and functions:

- Administer Department of the Navy and other Department of Defense shipbuilding, design, conversion, and facility contracts at private shipyards.
- Procure and administer overhauls, repairs, alterations, activations, and inactivations on naval ships under master contracts with private shipyards.
- Provide contract administration services for all DOD contracts awarded to plants according to the plant cognizance program.
- Carry out mobilization logistic planning functions, which include responsibility to (1) perform planning assigned in the NAVSEA Logistic Support Plan (LSP), and prepare and maintain a subsidiary mobilization logistic support plan; (2) do Industrial Mobilization production Planning (IMPP); (3) serve as Armed Services Procurement Planning Officer (ASPPO); and (4) maintain the Register of Planned Emergency Procedures (RPEP) for assigned facilities.
- Supervise the installation of ordnance equipment on merchant ships at private yards.
- Carry out NAVSEA's marine salvage duties within the naval district.
- Provide technical guidance in the matters in this list to all naval activities in the assigned naval district, to the area coordinator, and to the Military Sealift Command (MSC).
- Provide administrative support services to perform other tasks as directed.

ORGANIZATION OF SUPSHIP

Figure 9-7 shows the organization of SUPSHIP. NAVSEA must approve any deviation from this standard organization. SUPSHIP is the direct representative of the command(s) for whom SUPSHIP is acting in official transactions with contractors. SUPSHIP reviews all correspondence between contractors and NAVSEA and recommends to NAVSEA the proper course of action. SUPSHIP administration ensures proper placement and administration of Master Contracts for Repair and Alteration of Vessels and job orders, timely and economical completion of overhaul and repair work, conformance of such work with specification requirements, maintenance of acceptable quality standards, and safe practices.

SUPSHIP STAFF

SUPSHIP delegates duties and responsibilities to the assistant officer-in-charge. In districts where SUPSHIP is the commander of a naval shipyard or the head of another activity, the assistant officer-in-charge,

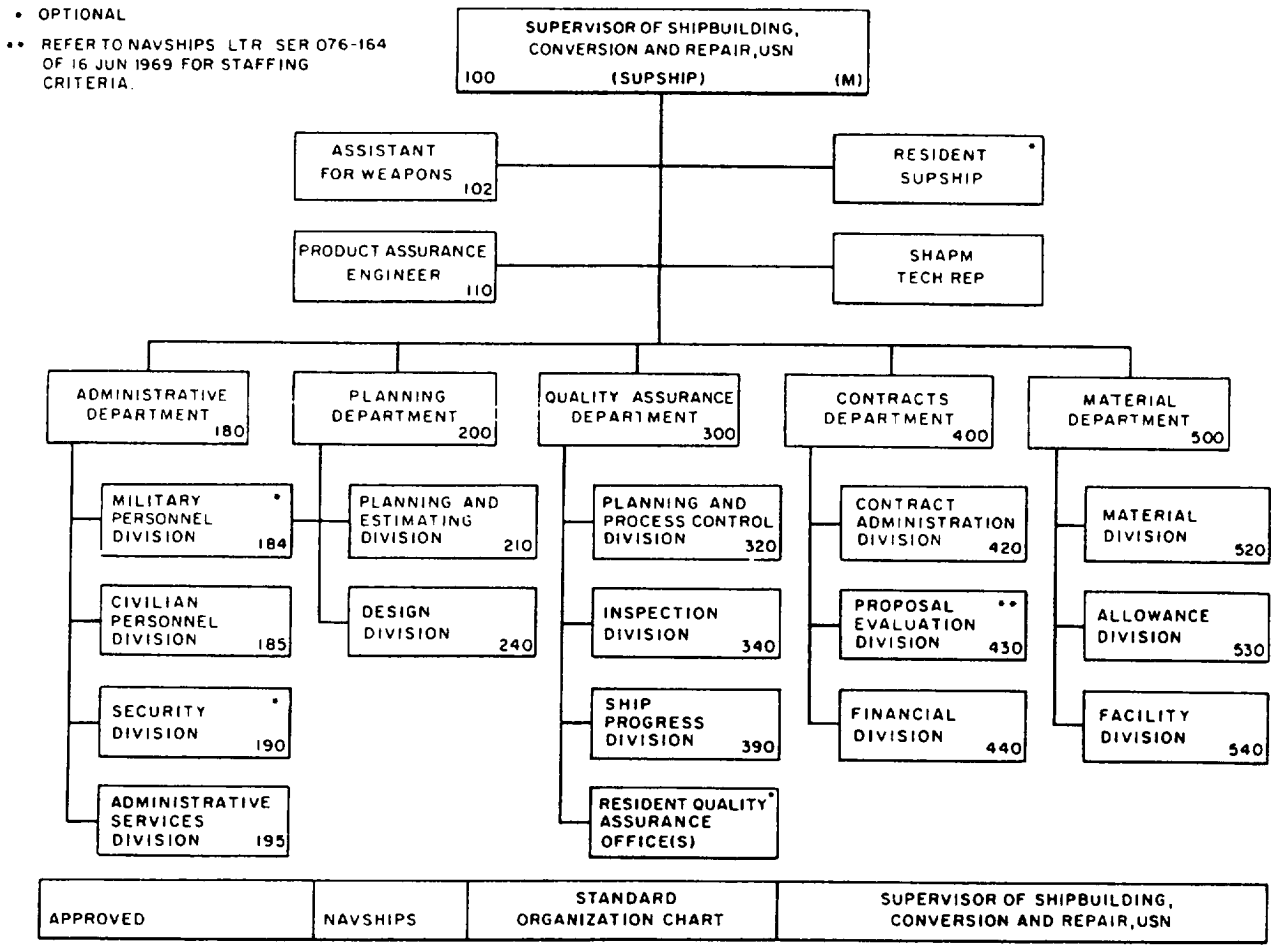

Figure 9-7.-Organization chart of the supervisor of shipbuilding, conversion and repair, USN.

normally the planning officer of the shipyard, serves as the administrative head of the SUPSHIP organization. The assistant officer-in-charge also administers public relations matters and ensures effective use of SUPSHIP personnel.

Another assistant, the assistant for weapons, is primary liaison for ordnance between SUPSHIP and NAVSEA. He is the principal advisor to SUPSHIP on weapons systems matters and the related technical direction. His broad responsibilities are to review specifications on weapons drawings, exercise technical control over weapons tests and design changes, procure and issue weapons, and control allowance lists and incomplete weapons work lists for the INSURV board.

The Product assurance engineer administers the SUPSHIP's Quality and Reliability Assurance Program. His responsibilities are to determine how well contractors conform to quality standards. He coordinates the quality assurance efforts of all SUPSHIP departments; provides liaison between SUPSHIP, NAVSEA, and the contractor to develop and apply quality and reliability assurance techniques; and develops and administers training programs for quality and reliability assurance.

The ship acquisition project manager (SHAPM) technical representative is used only in conjunction with major projects. The incumbent in this position works for SUPSHIP but receives supervision and technical direction from the project manager.

SUPSHIP DEPARTMENTS

The following sections deal with the major functions of the typical departments of a SUPSHIP organization shown in figure 9-7.

The Administrative Department

This department serves the SUPSHIP in naval and civilian personnel matters, industrial relations, public

relations, security, and office services. The administrative officer (military and civilian) serves as security officer for the activity and establishes procedures for internal and industrial security administration for the SUPSHIP organization. He is also responsible for administrative matters concerning precommissioning detail. This department contains the following divisions:

The military personnel division is optional. If it is present, it administers military personnel matters.

The civilian personnel division administers civilian personnel matters and provides local public relations services.

The security division is optional. If it is present, it administers the internal security program for SUPSHIP.

The administrative services division provides office services and administers the SUPSHIP civilian payroll and fiscal records.

The Planning Department

This department provides work planning and design services needed to administer contracts. There are three major functions in planning for ship overhaul and repair: (1) planning coordination, (2) job planning, and (3) support functions, as we'll explain in the following paragraphs:

1. Planning coordination may be broken down into the following (1) external and (2) internal functions:

a. External coordination is the planning done by SUPSHIP personnel with outside activities. Some examples are to arrange availabilities, receive and distribute work requests and authorizations for alterations, schedule and coordinate SUPSHIP planning and bidders inspections with ships forces, and arrange for firm funding.

b. Internal coordination is in two parts: (1) work requests are distributed to job planners, and (2) planning personnel assemble and review the information from the job planners and others, such as final work items, cost estimates, requests for drawings and technical information, and government furnished material (GFM), before distributing them to other activities that will act on them.

2. Most SUPSHIP planning is carried out by job planners. These are specialists in the major trade areas of hull, mechanical, electrical, ordnance, and electronics. They receive and evaluate work requests and alterations documents; inspect the ship; request drawings, technical information, and GFM; and prepare work orders and cost estimates.

3. SUPSHIP support services include services, some of which may be located outside the SUPSHIP office, such as typing and duplicating, drawings, and technical information.

The planning department is made up of the following divisions:

The P&E division provides engineering and technical design services to SUPSHIP and NAVSEA and coordinates with contractors and other activities to exchange technical plans and data. This division administers the Value Engineering Program.

The design division provides the necessary drawings, technical information, and design services for overhaul and repair work.

The Quality Assurance Department

This department determines the progress of work and oversees the contractors' systems for the control of quality in the production phase. This includes oversight of inspection, final testing, trials, and deliveries of work under contract to ensure compliance with approved drawings, contract specifications, and compietion dates. The quality assurance department consists of the following divisions:

The planning and process control division develops and coordinates the quality assurance program for the department; prepares, schedules, and monitors audit plans; administers the Defect Prevention Report Program; coordinates test memo review and documentation; analyzes feedback information and follows up on the corrective action; and maintains services such as blueprints, technical manuals, test calls, and central files.

The inspection division witnesses inspections and tests and records inspection data, oversees the contractors quality assurance programs, administers qualifications of special process operators, inspects GFM, initiates defect prevention reports (DPRs), administers safety and fire protection programs, and validates contractor technical data.

The ship progress division assembles and disseminates information on all SUPSHIP shipbuilding, conversion and repair work, originates and maintains schedules and progress charts; and submits required reports to local and higher authority.

The Contracts Department

This department is responsible for all contractual, accounting, and financial matters relating to prime contracts. It awards and administers all master ship repair (MSR) contracts and job orders for repair and overhaul work.

The department contains the following divisions:

The contract administration division reviews and consents to subcontracts, prepares final settlement documents, procures all repair and overhaul services under the MSR contract, administers job order terminations, and requests advisory audit reports.

The proposal evaluation division coordinates all changes and requests for changes on each ship.

The financial division certifies vouchers for payment and keeps accounting records of work funds allocated to SUPSHIP.

The Material Department

This department oversees SUPSHIP's fitting-out responsibilities. It controls delivery and disposal of GFM, administers property, prepares and maintains allowance lists, conducts pre-award surveys, and administers facilities contracts. The department contains the following divisions:

The material division oversees the acquisition of all material needed by the contractors.

The allowance division oversees each ship's allowance list for new construction or conversion.

The facility division oversees the administration of all contracts for facilities required to handle ship overhauls.

REGULAR OVERHAUL

All ships of the fleet are assigned regular overhaul periods that last from 2 to 18 months depending on the size and complexity of the ship. The interval of time between regular overhauls varies from 2 to 5 years depending on need. During the overhaul, work is done by the ship forces and shipyard forces depending on capability and advance planning.

An analysis of the problems of building, overhauling, or converting ships reveals the following factors in common:

- The ship's availability must be for the uninterrupted period of time needed to complete yard work.
- There must be a decision on the work that needs to be done and upon the priorities in which it will be done, and there must be an authorization to do the work.
- The necessary funds, material, and personnel must be available.

ADVANCE PLANNING

There are two kinds of advance planning. The first is the continuing Navywide development of long-range schedules for the overhauls of all Navy ships, and the second is the long-range planning for a specific ship that is due for an overhaul.

Navywide Planning

Long-range planning for all Navy ships includes consideration of the following points: (1) the home ports of all ships and their nearest shipyards, (2) previous overhaul availabilities of ships compared with proposed overhauls, (3) shipyards that can do special kinds of work and ships that need that work, (4) providing enough work in all shipyards to avoid laying off personnel intermittently, (5) the availability of critical material on important jobs, and (6) any special problems that may arise. The final approved schedule represents the best compromise possible. The material commands, the yards, and the force afloat use it as the basis for their long-range planning. From time to time, the schedule may need changes and adjustments, and in those cases CNO evaluates and approves or disapproves proposed changes in the long-range schedule. The TYCOM may change start or completion dates subject to agreement by the shipyard commander or SUPSHIP when the change is 3 weeks or less from the assigned date.

Individual Ship Planning

The advance planning for an individual ship that is scheduled for overhaul begins about 18 months before the overhaul. During that time, plans progress from a rough stage to a definite schedule of work to be done and the time, materials, personnel, facilities, and funds needed to do it. These advance plans include preparation for the factors listed here and discussed in the following paragraphs: (1) work to be done by the ship's force, (2)

training of persomel, (3) security of the ship, and (4) a leave schedule.

SHIP'S FORCE WORK.– Before the ship enters the yard, and in some instances while it is in the yard, the ship's force will do all work within its capability. A schedule of ship's force work should include names of persons responsible for each job, estimated date of completion, estimated number of man-hours required, and the assistance in way of materials or tools required from the yard. Copies of the ship's force work item list must accompany the ship's repair requests and work item lists.

TRAINING DURING OVERHAUL.– Make plans and develop schedules to train personnel during the overhaul. Use local training facilities and fleet schools as much as possible where such training does not interfere with a good overhaul. Take advantage of the overhaul to involve junior ratings in OJT experience under qualified seniors. Develop an objective to be met by the end of the period and an outline of the training to be completed.

SECURITY OF SHIP'S SPACES.– Planning should cover the security of ship's spaces, including protection against fire, flooding, theft, and sabotage. The shipyard is prepared to help with security, but the ship is responsible. Schedule fire watches, and schedule regular inspections to look for flooding, theft, or sabotage.

LEAVE SCHEDULES.– Try to clear backlogs of leave during regular overhaul periods. schedule an equitable distribution of leave while maintaining a force of inspectors and other personnel to be sure inspections and ship's force work will be done on schedule.

ASSIST-SHIP'S-FORCE FUNDS

During an overhaul period (and certain restricted availabilities) a portion of the repair funds may be designated as an assist-ship's force fund. This fund is under the local control of the ship's commanding officer. It allows the CO to get minor shipyard help (services, labor, or special tools and equipment) to help ship's personnel complete work. These funds may be used only for work in which the ship's force participates. Generally, the engineer officer and the ship superintendent administer the assist-ship's force fund.

DOCKING

Naval ships are docked in drydocks or marine railways to paint the ship's hull, examine the underwater fittings, or repair damage. Docking for painting and hull examinations is usually done routinely during regular overhaul periods. Damage repairs often require emergency docking that must be done as needed.

A docking officer in a naval shipyard and a dock master in a private shipyard, are in charge of the general operation of their respective drydocks. The docking officer normally visits the ship about 1 week before the actual docking and discusses detailed docking arrangements. As soon as a ship arrives at the Shipyard, the ship superintendent gets its docking plan and checks the draft and the list of the ship. He then checks the ship's docking plans against the shipyard's file copy of the docking plan (if there is one) to make any corrections caused by work done elsewhere.

In laying out a drydock, the ship is generally located as close to one end of the drydock as possible to allow the setting of blocks for the following ship. Dimensions are ordinarily taken from the after edge of the ship's main deck to the after edge of each block. This determines the fore and aft location of the blocks. The shipwrights determine the fore and aft centerline of the keel block and measure the athwartship locations of the blocks from this line. Vertical heights are measured from a plane established by a public works engineer. After the dock has been set and before it is flooded, the docking officer checks the dock to be sure the blocks are located properly and that the ship will not be damaged.

Before the ship enters the dock, the docking officer instructs the working party in its duties. The commanding officer of the ship being docked is in charge until the bow (or stem) reaches the dock sill and the ship is pointed fair to enter. The docking officer then takes formal charge until the ship has been landed, the bilge blocks hauled, and the dock pumped down. The docking officer ensures that all lines are handled to control the ship until it is safe in the dock.

After the dock has been completely checked, the docking officer gives the order to flood the dock, and remains at the dock until all the blocks are well covered to ensure that no blocks are torn loose or misplaced during flooding.

When the ship is settled in the dock work begins on the overhaul, which is discussed in the section of this chapter on Shipyards. In addition, the ship's force carries on its scheduled repair work when it does not interfere with the shipyard work.

Within 10 days before a ship is undocked, the shipyard sends a report to NAVSEASYSCOM with copies to the commanding officer and the TYCOM. The

report is a general statement of when the ship arrived, why it is in drydock, the work the shipyard did on it, and any problems not resolved.

When work in the drydock has progressed to the point that its completion can be accurately forecast, the ship is scheduled to be undocked. The docking officer directs all arrangements for undocking. When preparations are complete, the docking officer orders the dock flooded to a point that lacks about 2 feet of lifting the ship from the blocks. Flooding is stopped. Each shop that worked on underwater parts of the ship checks its work for tightness, and the ship's personnel make an overall check of the watertight integrity. Reports of satisfactory condition are made to the docking officer before he will resume flooding. The docking officer is in direct charge of the undocking until the bow crosses the sill.

INCLINING EXPERIMENTS

We will explain inclining experiments at this point because they are often done when the ship is floating steadily in a flooded drydock. These experiments also may be done in any calm water where heavy weight-moving equipment is available. The experiment consists of moving known weights certain specified distances across the deck and recording the angles of heel produced. The data are then used to calculate the vertical position of the center of gravity.

When a ship is constructed, all components used in construction are weighed and the data are used to calculate the vertical position of the center of gravity. The data are then confirmed by an inclining experiment carried out on the first completed ship in the class. The experiments are then repeated periodically on typical ships of that class throughout the life of the class.

NAVSEASYSCOM orders inclining experiments on certain ships to learn whether the center of gravity has shifted since the ship was commissioned, and why. The purpose is to determine any rise in the center of gravity due to added weight over a period of years and to compute the effect of this rise on the stability characteristics of the ship.

DOCK AND SEA TRIALS

The section on Ship Trials that appears later in this chapter gives more information on trials. We will discuss dock trials and sea trials here because they are normally carried out following most major repairs or alterations.

The ship's CO directs the engineer officer to conduct a dock trial as soon as possible after repairs or alterations have been completed. The purpose is to determine the condition of the electrical and main propulsion plants. The ship superintendent witnesses the trial. If there are any problems, the ship superintendent must have them corrected and hold another trial. They repeat this process until all problems are resolved.

A sea trial is held as soon as possible after the dock trial has been completed if the shipyard commander (or SUPSHIP) and the ship's CO consider it necessary. The ship's CO conducts the sea trial on those repairs or alterations he feels should be tested. A sea trial includes a full-power trial unless the ship's CO wants to wait until new machinery parts have been run in and crew training will support the trial without fear of damage.

READINESS FOR SEA

The TYCOM normally allots the ship a readiness for sea (RFS) period immediately after the overhaul is completed. The ship's force uses this time to return the ship to unlimited operational status. The RFS period normally will be less than 7 days, and it may be omitted if there is an immediate operational need for the ship. The shipyard may not use this time to complete unfinished overhaul work. If the shipyard needs additional time, it must ask the TYCOM for an extension, and it must finish the work before the RFS period begins.

DEPARTURE REPORT

The planning department of SUPSHIP or the naval shipyard submits a departure report within 60 days after an overhaul is completed. This report tells all interested activities what overhaul work was scheduled, how much was completed, and what it cost. A departure report serves the following purposes: (1) The ship can correct records showing its material condition (2) TYCOM can evaluate the overhaul and adjust accounts allotted to its administration, and (3) the responsible SYSCOM can learn what alterations were done and what they cost.

SHIP TRIALS

The Navy requires ship trials to determine such things as performance characteristics, readiness for service, the extent of needed repairs, the adequacy of completed repairs, and the most economical rate of performance under various conditions of service. This information on ship trails is quite broad. If you expect to take part in any of the trials, study the general

procedures and instructions for these trials in the shipbuilding specifications and in special instructions issued by CNO and INSURV. Those who may be involved with ship trials should have a thorough understanding of OPNAV Instruction 4700.8 and INSURV Instructions 9080.2, 9080.3, and 4730.11. Another good reference is *Total Ship Test Program for Ship Production,* NAVSEA 0900-LP-095-2010.

Those instructions usually explain who will conduct, observe, and evaluate the trials; who may attend as unofficial observers and for training; and the procedures required to conduct the trials. This chapter contains information on the following broad types of ship trials, some of which include more specialized trials:

- Contract trials
- Special trials
- Pre-inactivation or pre-overhaul trials
- Recommissioning trials

CONTRACT TRIALS

New ships and conversions done in naval or private shipyards must undergo ship trials before they are accepted by the Navy. These trials are held to show that the ship is seaworthy and satisfies the operational and technical criteria established by CNO, the SYSCOMs, and the shipbuilding plans and specifications. Contract trials include builder's trials, acceptance trials, and final contract trials, some of which may be combined under certain conditions. We will explain each of them in the following pages.

When a conventional ship is built or converted in a private shipyard, contractor personnel operate the ship through the ship's CO during the builder's and acceptance trials. SUPSHIP inspection officers observe the trials and evaluate results. The SUPSHIP inspection officer signs a completed test or trial memorandum to show acceptance of a satisfactory trial. He then forwards the memorandum with the trial data to the SUPSHIP planning department for approval before it is included in the *Ship Information Book*.

A ship constructed or converted in a naval shipyard is usually commissioned several months in advance of sea trials; therefore, the ship's force usually carries out dock and sea trials. The shipyard's ship superintendent observes and evaluates the trials for the shipyard commander.

For nuclear ships, the private contractor or naval shipyard conducts dock trials up to the time the reactor is made critical. The officer in charge then conducts the remainder of the dock and sea trials under the overall direction of the shipyard commander or SUPSHIP.

During the final weeks of work when the builder is preparing for and conducting ship trials, and before the acceptance trial, the engineer officer should submit to the ship's CO lists of incomplete or unsatisfactory work and lists of alterations and improvements essential to the ship's mission. The CO should resolve the discrepancies with SUPSHIP or the shipyard commander, and submit requests for additional work to NAVSEA or INSURV where the shipyard is not responsible for corrections.

Builder's Trials

The builder of a new ship or major conversion must conduct enough dock and sea trials to be reasonably sure the ship will meet the contract requirements just before it undergoes its acceptance trial. In a private shipyard, the contractor conducts these trials on conventional ships and a SUPSHIP representative and the prospective ship's CO observe them. (See the preceding paragraph for nuclear ship trials.) For submarines, the shipbuilder's specifications contain requirements for the builder's trial.

DOCK TRIALS.– When the installation and testing of all machinery in the engineering spaces are about complete, the builder conducts dock trials to show the SUPSHIP and the prospective engineer officer that the ship is ready for sea trials. When personnel other than the ship's force conduct dock or sea trials, the engineer officer should arrange to have his operators observe the operations at the watch stations they will be expected to man after the ship is commissioned.

SEA TRIALS.– The builder's sea trial should take place as soon as possible after the builder's dock trial. It should show that the ship is seaworthy and that all its machinery and equipment are ready for the acceptance trials. A sea trial also shows the proper operation of electronics installations (such as air search radars, sonar, and similar equipments) that require land-free area and deep water to operate properly. The sea trial should include all tests that cannot be performed with the ship moored. When the sea trial has been completed, SUPSHIP or the shipyard commander notify INSURV of the results and any deficiencies that cannot be corrected before the acceptance trials.

Acceptance Trial

An acceptance trial is conducted to show that the ship was constructed or converted according to contract specifications. Members of an INSURV regional board or subboard inspect the work and witness the acceptance trial, and INSURV Instructions 9080.2 and 9080.3 describe the required tests and demonstrations. The INSURV board may call for other tests and demonstrations if it sees a need INSURV may authorize acceptance of the ship for restricted service, or require another trial after deficiencies have been corrected. Also, it may accept the ship contingent upon the completion of some work before delivery. When acceptance is conditional, the INSURV board generally delegates to the SUPSHIP or the shipyard commander the authority to decide when the conditions have been met. SUPSHIP or the shipyard commander then notifies the accepting authority, if it is impractical for the INSURV board to meet again.

Just before the acceptance trial, the responsible SUPSHIP office or the planning department of the naval shipyard compiles the list of trial items for the INSURV board. These include unsatisfactory items found during construction or conversion, testing, inspections, or earlier trials. The INSURV board may require any or all of the following trials and tests during the acceptance trial: full-power trial, quick reversal and backing trial, boiler overload test, locked shaft test, steering ahead, and steering astern.

During or immediately following the trial, INSURV (in conference with representatives of interested SYSCOMS, the ship, and the contractor) passes on the trial items submitted. INSURV officially classifies each item according to INSURV Instruction 4730.11, and adds any items resulting from the boards observations and inspections.

When the acceptance trial has been completed, the INSURV board decides whether to accept the ship as of the scheduled end of the construction or conversion period, or at a later time. They decide on the basis of the results of the trial and the material inspection, the seriousness of the work recommended, and the advice of the SUPSHIP or the shipyard commander concerning the time needed to do the work. The board may find that the deficiencies are serious enough to require another trial after they have been corrected. If so, they direct SUPSHIP or the shipyard commander to recommend a date for the next trial and a new delivery and acceptance date.

When INSURV decides that the deficiencies reduce the ship's fitness for naval service but do not justify rejection of the ship, they may recommend conditional acceptance for restricted service. The restricted service limitations may be removed when the deficiencies have been corrected to the satisfaction of the TYCOM and approved by CNO. Under special circumstances, the TYCOM may request a waiver with approval by CNO.

Final Contract Trial

INSURV normally conducts the final contract trial and material inspection about 6 months after acceptance, or conditional acceptance, of the ship and before the end of the guarantee period. The object of the trial is to determine if there are any defects that the contractor caused and has not corrected. The engineer officer must ensure that certain reports, test data, and publications are available for inspection by the INSURV board members immediately upon their arrival. See INSURV instructions for a list of these items. The ship's CO also must submit to INSURV the work items that were unfinished at the preliminary acceptance trial, or were authorized later, and which are not yet completed.

The ship's force conducts the final contract trial under the supervision of the INSURV board. The trial normally includes a full-power trial. As soon as possible after the trial, the engineer officer or INSURV board members make a thorough examination of those machinery parts that INSURV selects. When the engineer oficer does it, he reports the results to the commanding officer, who forwards the report with comments and recommendations to INSURV and to NAVSEA. Any defects must be corrected as soon as possible after the final contract trial.

If INSURV finds the ship is acceptable, the President of INSURV recommends to the Secretary of the Navy that the ship be accepted as of a certain date. For ships constructed or converted at a private shipyard the date usually coincides with the date the guarantee expires. If there are defects, INSURV recommends corrective action. The Navy will correct these defects and deduct their cost from the final payment to the contractor for ships built in private shipyards. When the Secretary of the Navy accepts the ship, it is assigned to operations with the fleet.

SPECIAL TRIALS

NAVSEA requires that trials be conducted on one ship from each class of ships, either new construction or major conversion, to determine various characteristics.

The results of the trials supply the data for the development of operational information furnished to all ships of the class. Other trials may be experimental to get data for design purposes. Trials also may be conducted on ships not considered as new construction or major conversion to determine the effect of newly designed equipment, such as a propeller or rudder. These trials require special instruments and are conducted by experienced technical personnel.

NAVSEA selects the ship for a special trial and submits a letter to the CNO asking for the use of the ship. When CNO approves, the TYCOM makes arrangements with NAVSEA to conduct the trials. NAVSEA outlines procedures for the trials and assigns responsibilities. Members of the ship's engineering department usually act as engineering observers and record data during the trials.

In addition to miscellaneous experimental trials and tests, there are standardization trials, tactical trials, plant efficiency trials, vibration trials, and noise trials. We wiIl explain each of them briefly in the following paragraphs.

Standardization Trials

In this trial, the ship is operated over a measured trial course at both heavy and light displacement. The purpose is to determine the ship's speed, shaft rpm, propeller thrust, and shaft horsepower characteristics. Test personnel use the data to prepare standardized curves for the displacement conditions of the trials, and issue them to all ships of the same class and to interested fleet and shore activities. The *Naval Ships' Technical Manual* and the trial agenda prescribe additional conditions for the standardization trials. The ship's underwater log is usually calibrated concurrently with standardization trials.

Tactical Trials

The tactical trials usually consist of operational procedures to determine characteristics of the ship relative to normal turning circles, acceleration and deceleration in a straight path, maneuvering, and special turns. Observations are made from stations aboard ship and ashore. NAVSEA will furnish personnel and instrumentation for these trials, and will analyze and prepare the data for distribution.

ECONOMY TRIALS

NAVSEA may conduct economy trials to determine the efficiency of the propulsion plant of a representative ship. The trial will depend on the type of propulsion plant in the representative ship and will be prescribed in the trial agenda.

Fuel data obtained during the plant efficiency trials are plotted directly on the standardization trial curves. The data represent the performance characteristics of the ship under ideal conditions and should not be used for logistics purposes.

NOISE TRIALS

The trial agenda prescribes the procedures used to conduct noise trials in a representative ship. For additional information, refer to NAVSEA 0900-004-3000, *Ship Acoustical Survey*. The trials conducted generally include one or more of the following surveys or tests:

- Airborne noise surveys determine the character of the noise in certain compartments and the remedial action required to reduce the noise to acceptable limits.
- Underway radiated noise trials determine the character and magnitude of the noise radiating underwater from the ship under various operating conditions.
- Self-noise trials determine the interference of the ship's noise with its sonar equipment.
- Overside noise tests determine the character of noise radiating underwater from individual equipments installed throughout the ship.
- Structural-borne noise trials determine the source and path of transmission of machinery vibrations to the water.

VIBRATION TRIALS

The trial agenda prescribes procedures used to conduct vibration trials in a representative ship. They may include one or more of the following tests:

- Hull vibration tests determine the character of vibrations in the hull structure resulting from propeller and wave action.

- Propulsion system vibration tests determine longitudinal and torsional vibration characteristics of the ship's propulsion system.
- Component, system, and structural vibration tests determine the character and source of local vibrations in specific units, systems, and structures.